Space Weather Technical Forecast

Issued on Monday, 07 November 2022 at 00:42 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of G1/minor storms. Chance of M-class flares (R1; Minor radio blackouts) throughout. Active fluence (1e8 integrated pfu) likely through much of the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low through the last 24 hours, with several C-class flares observed mainly originating from the largest region on the visible disc, AR3141. There are six numbered active regions, which are mainly covering the northern hemisphere. The aforementioned large region AR3141 in the northeast, and two moderately sized spots with one in the northeast, AR3140, and the second in the northwest AR3135. The remaining spots AR3136, AR3137 and AR3142 are small and simple. No Earth-directed coronal mass ejections have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, observed by DSCOVR at L1, is showing a declining influence from coronal hole 39 with speeds easing from slightly elevated, 450 km/s to slow-ambient, around 390 km/s. Density was around average or below. Total magnetic field strength, IMF, has been weak, with levels remaining below 5nT. The north-south component, Bz has varied weakly, ranging from +3/-3nT. Phi angle has been mostly positive (away from the Sun). Geomagnetic activity was observed to be at Quiet levels (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has remained at high levels, reaching a peak of 8.97e3 pfu at 06/1500UTC. Electron fluence levels have steadily risen to reach 4.96e8 integrated pfu at 07/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low, with a 40% chance of Moderate activity.

Solar Wind / Geomagnetic Activity: No Earth directed CMEs feature in the forecast. Winds are now slow-ambient. Coronal hole 40 or 42 may connect with the Earth during day 2 (8th), although there is low confidence in strength. There is a chance that the Earth may connect to coronal holes 41 or 43 on days 3 or 4 (9th or 10th), however their impact on the Earth is expected to be minimal. Geomagnetic activity is expected to be mainly Quiet with some Unsettled intervals possible at times. There is a slight, perhaps increasing chance of Active or G1/Minor Storm intervals through the period due to successive arrivals of coronal hole high speed streams.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) is expected to continue at high levels much of the period. Electron fluence values are expected to remain above the Active (1e8 integrated pfu) threshold through the period due to elevated electron flux values, with a slight chance of reaching Very High (1e9 integrated pfu)

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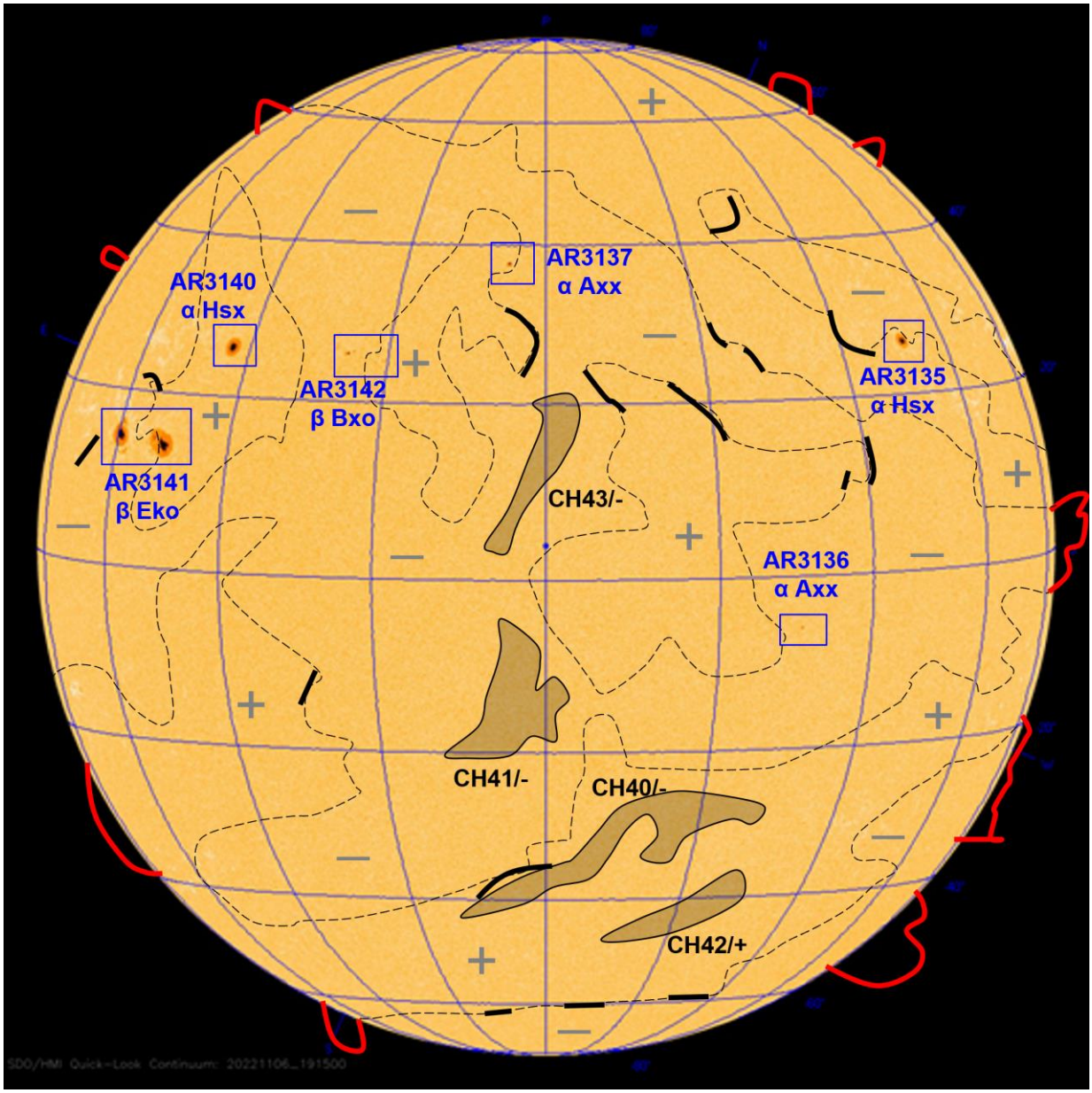
levels later in the guidance period.

Figure 1. Solar Analysis Valid 06/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

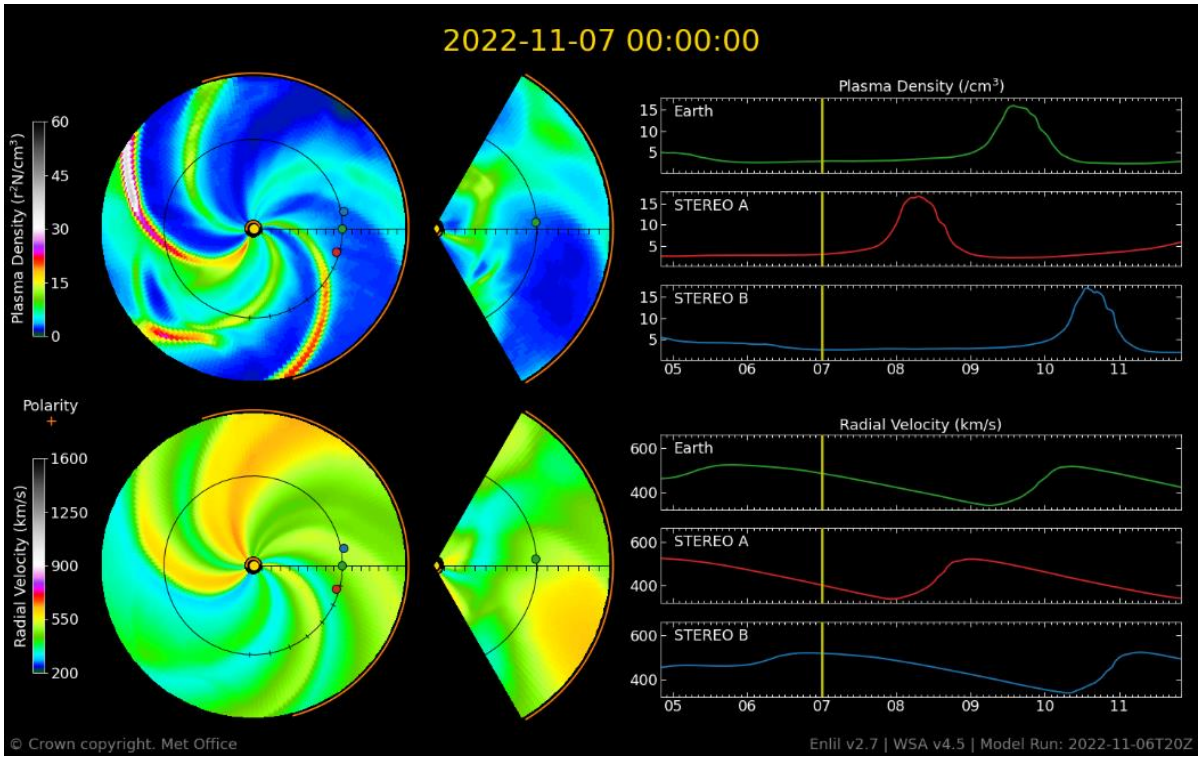
No Earth directed CMEs feature in the forecast.

The high speed stream from CH39+ continues to wane, with speeds now slow-ambient. Coronal hole 40 or 42 may then connect with the Earth during day 2 (8th), although there is low confidence in the strength of any connection. There is a chance that the Earth may connect to coronal holes 41 or 43 on days 3 or 4 (9th or 10th), however their impact on the Earth is expected to be minimal due to their negative polarity as we slowly edge away from the autumn equinox.

Geomagnetic activity is expected to be mainly Quiet with some Unsettled intervals possible at times. There is a slight, perhaps increasing chance of Active or G1/Minor Storm intervals through the period due to successive arrivals of coronal hole high speed streams.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	10	15	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: ENLIL showing a continued decline until 9th or 10th when the next enhancement is expected.



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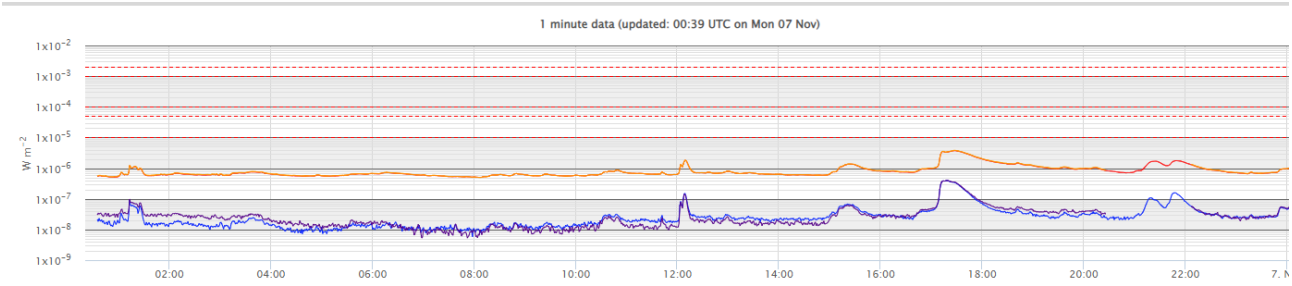
Radio Blackouts - X-Ray Flares:

There are six numbered active regions on the visible disc. AR3141 in the northeast is the largest and most complex region on the disk, classified Eko/Beta with a large leader and large trailing spot. AR3140 in the northeast is the second largest region, with a moderately sized mature spot, Hsx/Alpha. The only other moderately sized unipolar spot resides in the northwestern hemisphere, AR3135, a Hsx/Alpha. All other spots are small and simple, classified as Axx/Alpha or Bxo/Beta.

Solar activity has been Low, with several C-class flares observed in the past 24 hours. Activity will probably continue Low, but there is a chance of an isolated M-class flare, probably originating from AR3141, to give Moderate solar activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	40	40	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-Ray trace for 6th Nov



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background levels and is forecast to remain at this level through the guidance period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) has remained at high levels over the past 24 hours with this likely to continue as a result of the recent input into the radiation belts. These levels will probably be maintained for much of the coming guidance period given that no significant geomagnetic activity expected. Brief declines are possible due to diurnal variations, but these are unlikely to be sustained.

Electron fluence is also expected to remain above the Active threshold (1e8 integrated pfu) for much of the period. The risk is considered lower towards the end of the period simply due to reduced confidence in any geomagnetic activity and rate of electron losses in the radiation belts.

There remains a slight chance of reaching Very High (1e9 integrated pfu) levels through the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	90	80	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	10	10	5

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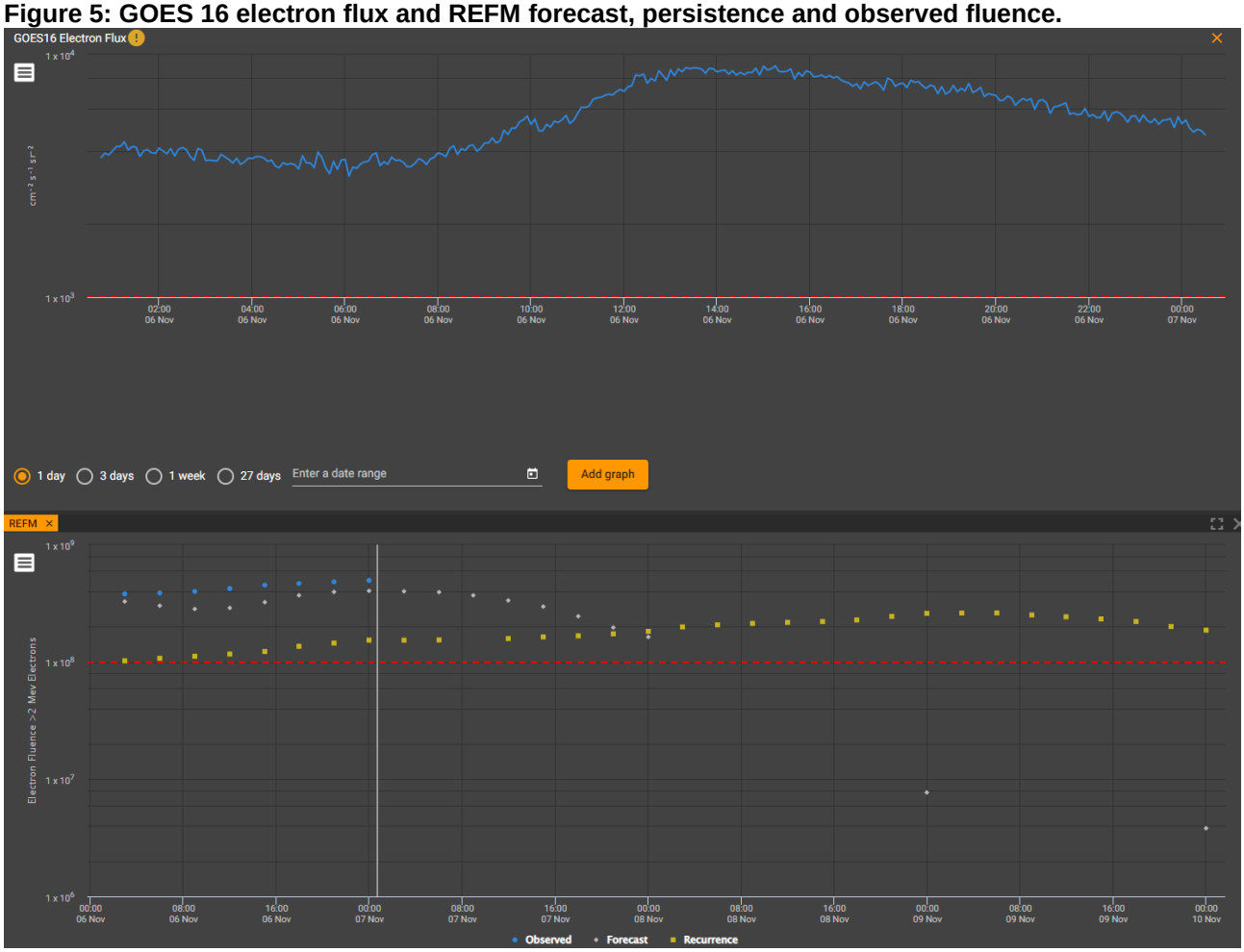
Figure 5: GOES 16 electron flux and REFM forecast, persistence and observed fluence.



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